A Miniature Windmill

THE MODEL ENGINEER

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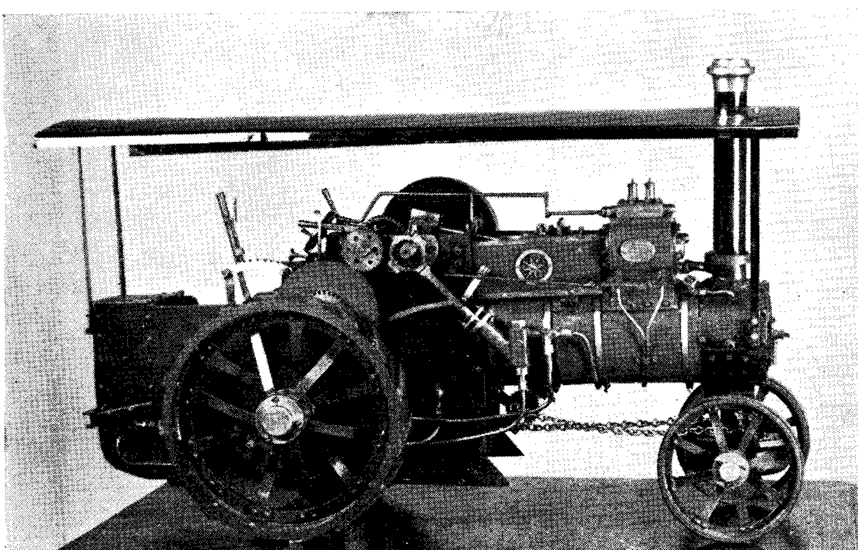
In this issue



Mr. E. J. Baughen's wife introduced him to a friend—" A man who makes boats " and a member of the local model engineering club, with the pleasing result that he made the model traction engine shown above as a " first attempt." The story of its construction and a further illustration appear on page 77.

THE MODEL ENGINEER

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Smoke Rings

Holidays at Home

I AM pleased to hear that the Malden Society's passenger track at Beverley Park, to the opening of which I recently referred, has proved an outstanding holiday attraction for the district. Queues of passengers have been forming up for rides on the 174 ft. track, and the locomotives and rolling stock have been kept fully occupied until 9 o'clock in the evening. On the first two days 1,250 children were carried at a fare of 1d. each and over £5 was collected for a local charity. News reaches me that the Manchester Corporation have also realised the recreative interest of models and are encouraging the local power boat clubs to organise regattas and demonstrations on the various park waters in the district. They are offering full running facilities, including assistance in providing petrol for the i.c. boats. Thus, models are contributing in a very practical way to making "holidays at home" both interesting and enjoyable.

The Old "Bury" Locomotive

THE photograph published on the cover of our July 2nd issue caused a number of readers to submit information as to the history of the particular engine illustrated. There can be no doubt whatever that this engine was one which worked at the Oakathorpe Colliery, and was the property of a Mr. J. B. Wilson, who managed the colliery. Unfortunately, however, the owners of the colliery became involved in a legal dispute, and Mr. Wilson was ordered to remove all the plant, including the locomotive. It was, eventually, put into a siding close to the signal-box at Wingfield, on the Midland Railway, where for some time it served as a stop-block! Apparently the photograph was taken at Wingfield. Later on, the old engine was removed to the goods yard at Wingfield station, and won considerable local fame as the principal plaything of the boys of the district! Then, in 1890, a Sheffield firm bought the engine and used it as a shunter at an iron-ore works at Frodingham, until about 1896, when, unfortunately, it was sent to the scrap-heap.

From Model Locomotives to Munitions

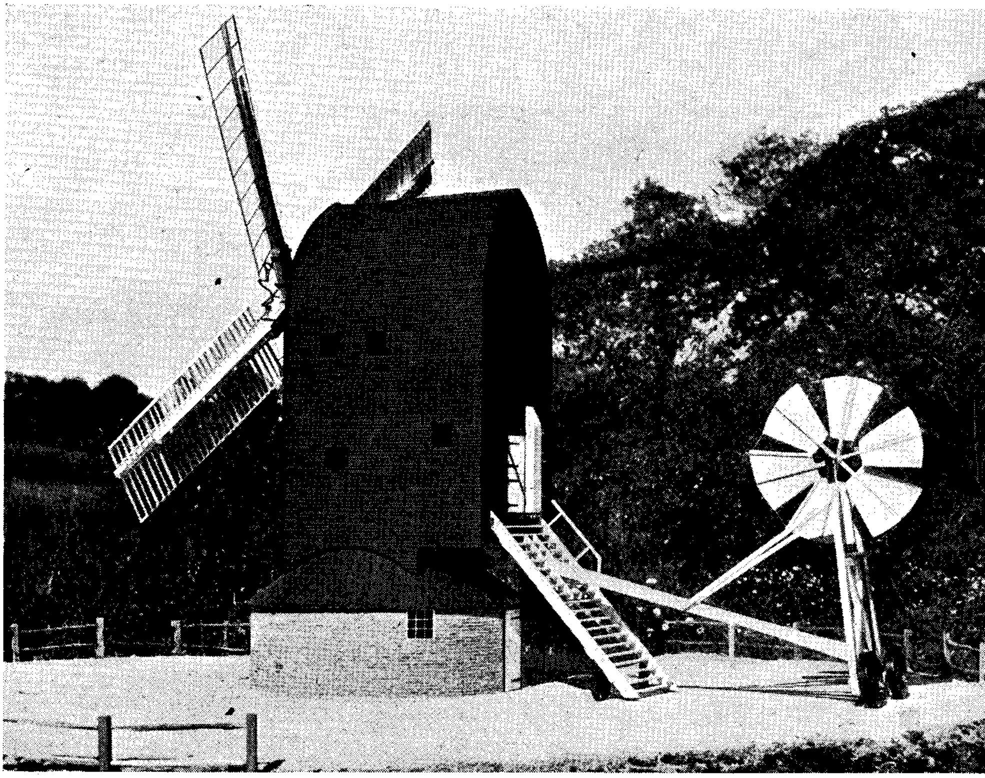
AN interesting development of a hobby workshop to a miniature munition factory has recently been related in the Press. It refers to the private workshop of Lt.-Commander Inglefield, a well-known personality in the model railway world, who has re-joined for active service in the Navy. His father, Rear-Admiral Sir Edward Inglefield, took over his son's workshop in London, equipped it with additional tools, and is now training boys and girls of from 16 to 17 years of age to manufacture parts for fighters and bombers. The shop is run on a non-profit basis, and is now turning out some 50,000 parts a week. A fine patriotic effort this, and another feather in the cap of model engineering.

Aviation and Model-making Ability

MY constant contention that model engineering stimulates mechanical genius and adaptability is borne out by a recent pronouncement of the military authorities in the U.S.A. I read in an American magazine that the authorities "have attributed the superiority of America's warplane fliers partially to the fact that they have been accustomed to handling mechanical toys, working models, power tools, and automobiles at various stages of their youth, thus getting early preparation for the operation of complex mechanical controls built into the skyfighters of this day and age." The fingers and brains of the model engineer have been trained to deal with mechanical problems of all kinds and the urgent needs of war-time production and fighting activities are bringing this fact into the wide recognition and utilisation it so fully merits. The judgment of the American authorities is based on experience and is obviously well founded.

Percival Marshall

R. Dorian Morse describes how he built
A True-to-Scale Model Windmill



A general view of the scale model windmill.

FOR a number of years I have taken a keen interest in windmills, and often thought what a pity it is that such landmarks should pass away without some attempt being made to secure records of them as they were in days gone by. I therefore came to the conclusion that a scale model was the most suitable means of achieving this. The first one constructed was ¼ in. to the foot, but proved too small to make it wind-driven, the working parts and minor details being so fragile as to make it impossible for me to construct; so I decided on something larger.

The mill I chose is at Henfield, being close at hand. Fortunately, I know the owner, Mr. Tobitt, and asked him for permission to take particulars, to which he readily consented and handed the keys over to me. This post-mill, which is fast falling into decay, discontinued to be worked in 1885, stands near Henfield Common, and is on elevated ground commanding a wonderful view of the South Downs.

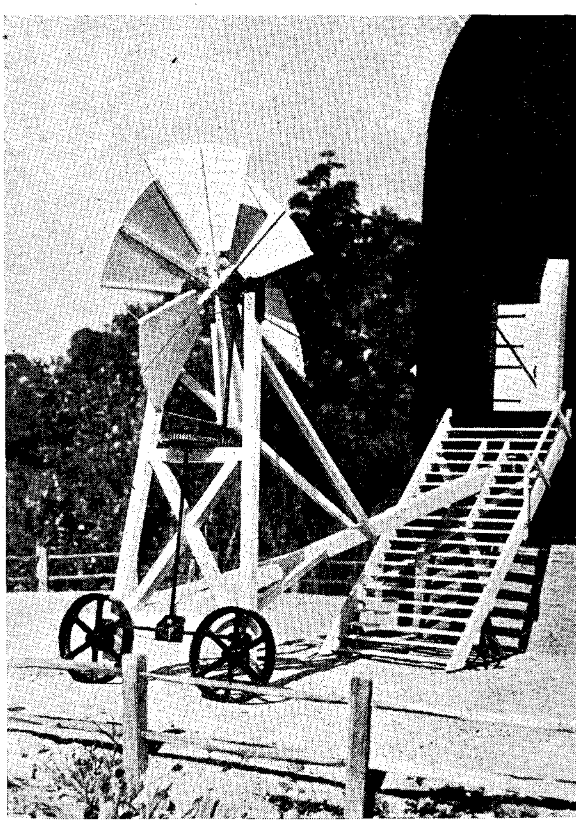
On arrival at the mill, I noted the fan-wheel was missing and one sweep broken off, the other three being shutterless and badly damaged. After some time spent in unlocking the roundhouse door, I entered the building, which was in quite good condition and, luckily, housed a number of sail shutters. The centre post and quarter-bars were as good as new. Below is a large cellar which was used for extra storage room and, so I was told, at one time contained a steam plant for running the stones when the mill was becalmed. As there are no steps from inside the roundhouse to the main body, I went up the old worn steps at the tail end. Inside, I found most of the machinery had been removed; however, I commenced to take measurements

with the help of my father, some of which are as follows :- The width is 12 ft., length 17 ft., and total height from ground level to top of body 40 ft. The span of sails is now 50 ft.; originally they were 62 ft., but were shortened, no doubt, on account of the danger to people on the ground. In all, we visited the site about a dozen times, taking hundreds of measurements required to make the model, and at last had enough data to enable a start to be made.

I decided to make the scale 1 in. to the foot, as in this size it would be quite possible to construct the sails as in real practice ; they are of the patent self-reefing double-shutter type, which comprises two rows of shutters connected to each other by sail-rods so that all work together. These, in turn, are connected to the striking gear, which is governed by weights. The principle is that, according to the strength of the wind, and amount of weight used to keep the shutters closed, the sails can be kept at a uniform speed. It will be readily seen that by taking off the weights and allowing the shutters to open, the sails will stop.

The fan-wheel at the back is set at right-angles to the sails ; any alteration in the direction of the wind causes the fan to revolve, and, through gearing, to transmit motion to the track wheels which run on a hard surface encircling the mill, turning the steps and whole body-work, which are carried on a central post in the middle of the roundhouse, thus bringing the sails up to the wind. In the model, the interior is not like the prototype ; it was necessary to create some form of load, so I fitted an ordinary domestic coffee mill. This had to be geared so low to get the required power to grind that it revolved too slowly and took such a long time to grind a few ounces of coffee that it was not worth while taking the mill outside. An alarm was fitted, as in real practice, to warn the miller when the hopper was empty. After using the mill like this for a time, I took out this mechanism and fitted a ball-type governor of suitable design, which has been quite a success. On the wind-shaft is a 9-in. diameter wooden brake-wheel which drives a pinion, also of wood ; this is mounted on a vertical shaft on which the governor is fixed, so that when the speed of the sails reaches a certain number of revolutions per minute, it operates a lever which applies a brake to the periphery of the brake-wheel, causing a load, so that any extra pressure on the sails opens the shutters and spills the wind.

A model of this size requires a large flat surface to turn on so as to face the wind from any direction ; so a circular mound was made in our field, about 9 ft. diameter, and 2 ft. 6 in. high, so as to see the mill to better advantage. The top is covered with tarmac and a scale size fence put around, complete with farm-type gate.



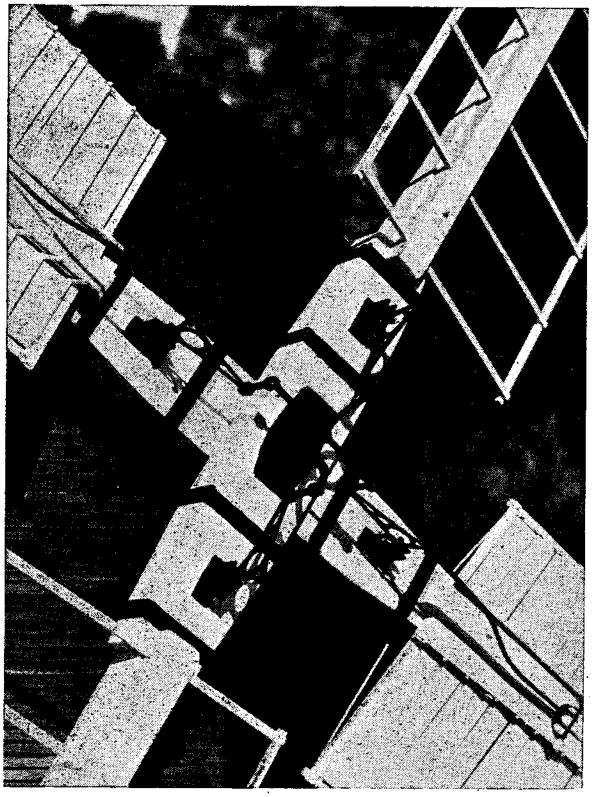
View showing the fan-carriage and steps.

Roundhouse

This comprises a wooden base, 21½ in. diameter, made from ½-in. thick planks, which are held together by angle-irons. In the centre is a metal tube, which serves as the centre post, and is securely fixed to the base. In the top end is a wooden plug turned down to fit inside ; this has a hole to take a ½-ball ; the weight of the body is taken on a cross member, to which is fixed a steel plate ; on the plate a piece of tube is brazed and fits over the outside of centre post, with the ball to take the thrust.

The brickwork presented some difficulty to get a realistic

appearance; however, this was overcome by making bricks as the real ones, from clay, which was quite easy to obtain by digging it from our field. After mixing together thoroughly, I forced it through an old screw-type grease-gun, with a rectangular nozzle at the end to form the surface shape of the brick, which is $\frac{3}{4}$ in. by $\frac{1}{4}$ in. As it required a considerable pressure to do so, I held the screwed end in the drilling-machine chuck, putting the back gear in to reduce the speed; this screwed the plunger down, forcing out the clay, and the length was then cut the required depth by hand, it being of no importance to make this dimension exactly the same, as it would not show externally, the outside surface being smooth.



A view of the striking gear.

After slowly drying these little bricks for some hours, they were baked red hot, a winter fireside job done on the lounge open fire; the only disadvantage was their liability to fly if they had not been sufficiently dried, or if heated too quickly. After making over 2,000, I started to build the wall. The bonding is plastic wood, this proving very successful, as it looks identical to cement when dry. The appearance of the finished article is pleasing, the natural colouring of the brickwork being very realistic. The entire wall was reinforced with 1/16-in. sheet steel, about $5\frac{1}{2}$ in. high, and held on to the baseboard by angle-brackets, leaving a gap of $\frac{3}{8}$ in. between the steel and inside of the bricks; the space was filled with putty and gold size mixed together. This backing added considerably to the strength of the wall, which by itself is not particularly strong.

On each side of the round-house a hinged door is fitted, made of plywood lined to represent boards. One has a workable lock, with scale-size key; the other is fastened from inside, and can only be opened after unlocking the first door and releasing the catch. There is also a window measuring $2\frac{1}{8}$ in. by $2\frac{1}{8}$ in., which has celluloid windows forming 9 separate panes. The roofing is made of millboard, supported on a wood frame, and rests on the brickwork, held central by the centre post. The imitation boarding is made up of separate pieces, cut on the taper and glued on. The roof is painted black to represent tar.

The Body

This was started by obtaining $\frac{1}{2}$-in. square wood to make a framework, there being four uprights to each side; these were joined 12 in. apart by strong beams. On top of each upright are fixed plywood ribs, to form the curve of the roof, and held on by metal plates, secured by bolts passing through. The front is not flat like the sides, but pointed, standing out about 2 in.; the construction of this part is similar to a ship's bow. The entire framework is planked with approximately 550 separate boards, $\frac{1}{2}$ in. by 1/16 in., and were glued in position with spaces left for the nine windows, which were fitted with weather-boards. To enable one to attend to the working parts inside, the back was made removable, it being held in position by two dowels at the bottom and a spring clip at the top. The back, as seen in one of the photographs, is fitted with an opening door and weight box.

(*Continued on page* 78)

A $1\frac{1}{4}$-in. Scale Free-lance Traction Engine

By E. J. BAUGHEN

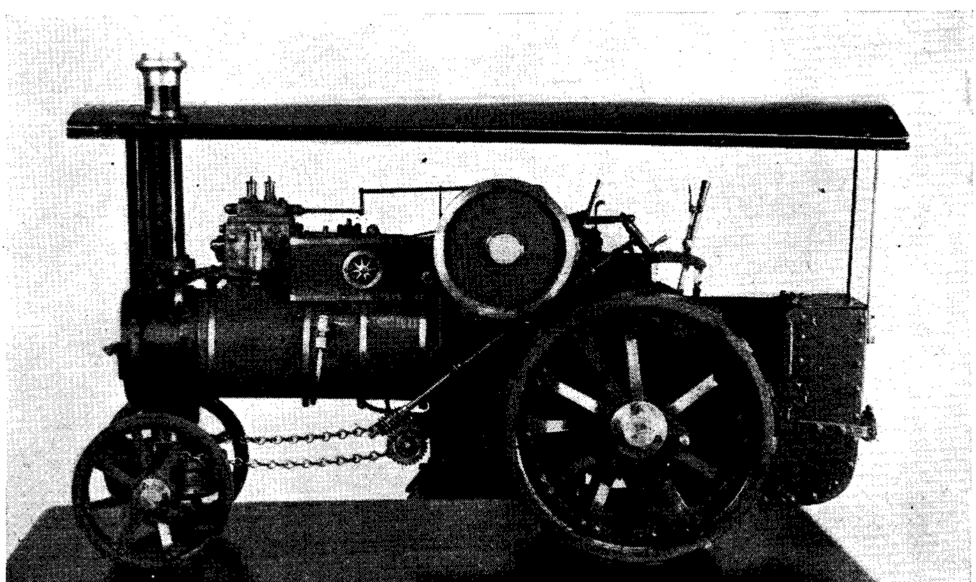
HAVING always had a fascination for traction engines, I often thought that I would like to build one, but not having the necessary equipment and experience the idea had to be put on one side; until one day I was introduced to a friend of the wife's, whose husband was, as the wife put it, "A man who makes boats." It wasn't long before I made his acquaintance, and found out that he was a member of the local model engineering club, so it was inevitable that I became a member.

When I saw the facilities offered by the club, and having had the kind loan of my new friend's workshop, I soon decided to go ahead with the idea of a tractor.

The engine was intended to be a $1\frac{1}{4}$-in. scale, but so many modifications have been made to the original drawing that it is almost free-lance. As is usual with this type of model, the boiler was made first, and this is where I had my first lesson. The brazing-up presented no difficulty, as I had access to an oxy-acetylene plant, but I could not get the stay bolts water-tight because I never tapped through the firebox and wrapper plates; and after using umpteen sticks of solder, decided to make a new one. This one turned out a success, and instead of having nine $\frac{3}{8}$-in. tubes, as per drawing, it has seven $\frac{3}{8}$-in. and twelve 5/16-in., with two $\frac{1}{2}$-in. water-tubes in the firebox, and has had 120-lb. water test.

The cylinder and motion work was the next job, and, with the aid of my good friend, were soon made and fitted to the boiler. Here I might mention that when the second boiler was made my friend suggested that a piece of $\frac{1}{8}$-in. copper plate should be brazed in the boiler shell directly under the cylinder saddle and motion plate, as normally there would be only a 1/16 in. to tap in to, but with the added plate this meant a thickness of 3/16 in. and less chance of thread stripping.

The engine then remained at this stage for twelve months, during which time such fittings as gauge glass, blower, check-valves, and pumps were made. About this time I bought a 3-in. lathe, and was able to rig up some sort of a workshop, and then the front wheels were tackled. These were made from the chucking-piece of a Diesel engine cylinder liner and meant a lot of hard work with the treadle. A pattern was then made for the rear wheel rims, and two castings $8\frac{1}{4}$ in. $\times$ $\frac{1}{2}$ in. were obtained in iron. These presented a bit of a problem, being too big for a 3-in. lathe, so I "took the bull by the horns" and asked my foreman if I



could turn them up at work. That must have been my lucky day, for he said "yes," and as I had taken them some days before in the hope of getting them done, I made a start straight away.

It was intended to have a double-tee rim, but as time was limited I had to be content with a single tee. After the four wheels were finished, the next things, were some suitable gears, and after a lot of scrounging I was able to work out a train with the reduction of 14 : 1.

The tender was next put in hand and made out of 16 g. copper, but another one has since been made with a larger water capacity.

Eventually, the great day arrived for trying the engine under steam, and after spending over an hour in trying to raise sufficient pressure, I managed to get it to stagger down the garden path, when the pressure fell from 50 to 0 in a very few minutes. Something was very much wrong, and after spending several weeks in fiddling about with the valve-gear I had still got no farther ahead, till one day I happened to read an article by "L.B.S.C." on a repair job he was doing to a loco., and how he opened out the exhaust pipe jet.

Now, in my innocence, I had made my exhaust jet only 1/16 in. diameter, in the hope of getting an extra draught, but all I got was back pressure in the cylinder, and on opening the jet out to 5/32 in. the result was amazing. So the whole of the valve gear was remade, a new crankshaft and heavier flywheel fitted and then another trial run. Here was something different altogether, and it will now pull two men with ease and with the pump full on will maintain 60 lb. of steam.

The whole of the construction has taken four years of spare-time work, and after many setbacks and disappointments I have at last achieved something, to my mind at least, worth while.

A True-to-Scale Model Windmill

(*Continued from page* 76)

Sails

Two pieces of wood called stocks, 1 in. by 1 in., tapering towards the tip, are held together by a metal cross screwed on to the wind shaft; on these are bolted longer lengths of wood, known as whips, and through these pass the framework of the sails which is a drive fit, and then supported by round rods, the ends of which are flattened, with 12 B.A. bolts holding them to the frame.

The other end is nailed to the stock. Passing through the whips are metal wires, on which the shutters move, the outer ends being supported by bearings, made of plastic wood which was pressed into a metal mould, a hole then being made before dry to support the wires.

These bearings were glued in position on the frame. The shutters were made of metal 0.020 in. thick, the top edge of which was rolled round to swing on the wires. It was not practical to make them of wood like the real ones, owing to the scale thickness and difficulty of fixing the levers, which are also of metal and soldered to the shutters. A jig had to be made to locate the angle of each, it being of the greatest importance that all should be alike; the levers are all connected to a sail rod, so it will be seen how necessary it is to set the position correctly, otherwise the shutters would not open and close in unison.

The sail rods are all connected to the striking gear, as will be seen in the third illustration.

The fan is 12 in. diameter, made of 1/16-in. thick wood, lined to represent boards. Down the centre of each vane is a ¼-in. square slotted spoke, fitting into a metal hub which is fixed on to the shaft; on this is a bevel-wheel which drives a vertical shaft, the lower end of which has a small pinion meshing with a larger wheel. The vertical drive is transmitted to two horizontal shafts through bevel-gears, and on the ends of these are worms; these drive worm-wheels fixed to the track wheels. The total reduction from fan shaft to track wheels is 250 to 1. All this gearing is mounted on the fan carriage, which is at the end of tail pole.

Steps

These are of wood let into stringers, carried on two metal wheels set at an angle. The wheels are 2 in. diameter, made out of a piece of copper tube with flat spokes slotted into a metal boss, and the whole lot soldered together. The body of the mill is painted dull black; sails, fan carriage, and steps white. It will be seen in the first photograph that only two sails are finished; these already contain 108 shutters, levers, bearings, and 216 celluloid washers.

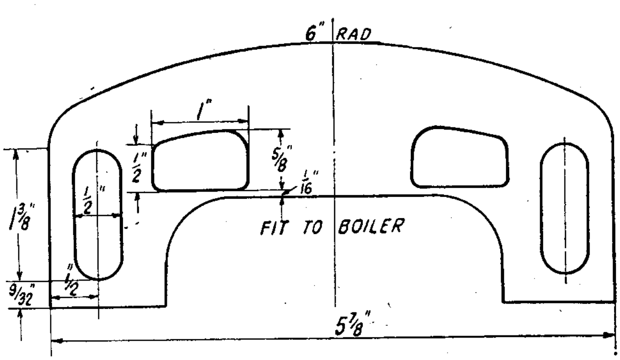
In conclusion, I might add I have already started making a smock mill, details of which I shall be pleased to give with the Editor's permission. At present, my time for model making is very limited owing to other work; however, I am looking forward to the days in the future when I can devote my leisure hours to mill modelling.

"Molly's" Cab and Bunker

By "L.B.S.C."

WELL, we are getting towards the end of the job; cab, bunker, hand brake column and a few trimmings, and "Molly" will be ready to show her I.C. sister, in friendly rivalry, the "rounds of the kitchen." The cab and bunker can be made from the same material as used for tanks, if any more is available, or ordinary soft blue sheet steel will do quite well, say, 18 or 20 gauge. The weatherboard or cab front needs a piece $5\frac{7}{8}$ in. long by $2\frac{3}{4}$ in. wide, which is sawn and filed to dimensions given in the illustration. Be careful to make the plate fit snugly over the firebox; and for novices' benefit once more I might repeat that the easiest way to get a proper fit is to cut a card or paper template (I call them Welldon patterns) to fit over the wrapper sheet, then lay it on the metal and scratch the outline with a scriber. Even in these days of paper shortage, it doesn't matter if you made a dozen or so scrap templates, they can all go in the salvage sack, but one spoilt metal weatherboard may cattle up the only piece of metal available—*verb. sap.*!

Another tip for tyros: don't cut out the window openings with a hammer and chisel; otherwise you'll never get the plate to lie flat any more! Either cut them with a metal piercing saw (coping saw, or glorified fret-saw, it's all the same kind of gadget) or else drill holes around the outline, break the piece out, and finish off the rough edges with a fine file. The complete weatherboard is attached to the tops of the side tanks by little pieces of angle brass, or bent-up angles made from the self-material, riveted to the lower edges of the weatherboard and attached to the tank tops by small brass screws.



Cab front or weatherboard.

The full sized "Mollies" have brass window frames carrying good stout glasses, and are, of course, hinged to open; but we needn't bother about opening windows on the little lady. However, it doesn't look very "enginelike" to see empty holes in the front and back of the cab, so cut out little sheet-metal window frames to the shape of the openings, either from thin brass or from the same material as used for cab, and attach them by the smallest screws you have (12 B.A. is the size I use) to the inside of the weatherboard, with pieces of mica or cellophane (former is by far the better if obtainable) between frame and weatherboard.

Bunker

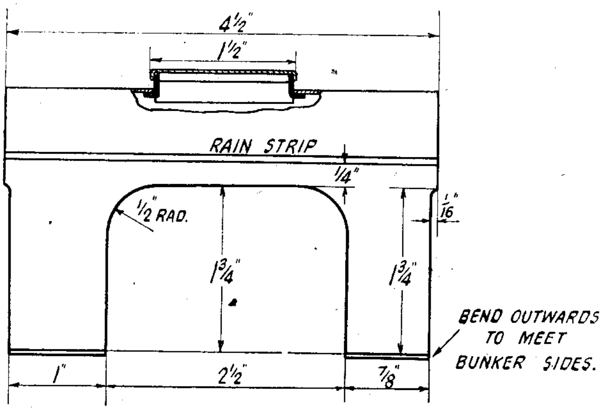
The sides of the bunker are cut from the same metal as mentioned above, to shape shown in the drawing. Pieces of angle are riveted along the bottom, up the back, and on the inside, the latter being needed to hold the back of the cab in position. The back of the bunker is a plain sheet, bent to suit the curve of the side sheets, the length being $6\frac{5}{8}$ in., less twice the thickness of the metal, so that, when assembled, the bunker is $6\frac{5}{8}$ in. wide outside the sheets. The back is riveted to the angles by 1/16-in. rivets, countersunk on the outside; but anybody who has, or can get the use of a little oxy-acetylene blowpipe, I can simply butt the sheets together, if made of steel, and either Sif-bronze them or braze them with brass wire. I use this process, and find it easier than using an ordinary soldering - iron. Apprentice boys in the old days used to regard the term "putting-on tool" as a standing joke, sending "green" newcomers to the stores to get one; but the myth has actually materialised in the shape of the oxy-acetylene blowpipe, for never was a tool more worthy of the title. It puts things on anywhere, with absolutely no trouble at all; and when Adolf makes his final journey with a single ticket to the place where they don't need any extra heating

apparatus, the "putting-on tool" will have had a great deal to do with his journey.

A piece of metal 2 in. wide and the same length as the back of the bunker is fixed across at the bottom, in the position shown by the dotted lines in the sketch of the bunker side sheet. Cut two slots in it to clear the frames, as shown in the other sketch. This forms the lower part of the back of the cab; and it can be a fixture, as it does not hinder the use of the firing shovel if made to the given height. The complete bunker can be attached to the running-boards or platforms by screws or bolts through the angles at the bottom of the side sheets; the back comes outside the back edges of the frame plates and rests on a fill-in piece of sheet metal, same thickness as running-boards, cut to fit between the frames at the back end, and attached by pieces of angle.

Back of Cab

A piece of metal 6⅝ in. by 3⅞ in. is needed



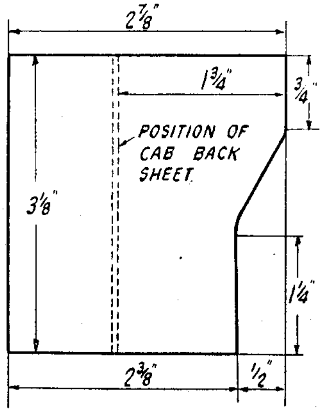
The cab.

for the back sheet of the cab. The upper part is cut to an outline exactly the same as the weatherboard, whilst the bottom is cut to fit between the two pieces of angle on each side of the bunker side sheets, as shown in the little detail plan sketch. The stepped part at each side of the upper section should be filed so that it is below the edge of the bunker side to a depth equal to the thickness of the metal. The cab sides are bent outwards and attached to these "steps," and when assembled and erected lie flush with the bunker top.

One-inch holes are drilled for the windows, which should be framed and "glazed" as described above. In addition, although there won't be any risk of the frisky lad on the coal crane hitting them with the "tub," and knocking the "glasses" out, the addition of protecting grids adds to the appearance of the engine and pleases our dear old pal Inspector Meticulous, so put them on. They are made of 1/16-in. wire, any kind will do, the "bars" being flattened at each end and riveted to the cab back by rivets made from domestic pins. Leave about 3/32 in. between the bars, and make them of varying lengths to suit the outline of the circular window. Alternatively, the window frames could be put outside the cab, and the bars simply soldered across them.

Cab Sides and Top

After much cogitation and sundry stirrings of grey matter in search of alternatives, I have come to the conclusion that the easiest way to remove the cab, in the present instance, for firing and getting at the "handles," is to make it as one unit with the upper part of the back, so that the whole lot can be lifted out, thus rendering the boiler backhead and firehole even more accessible than they would be on an ordinary tender engine. To replace, the lower edges of



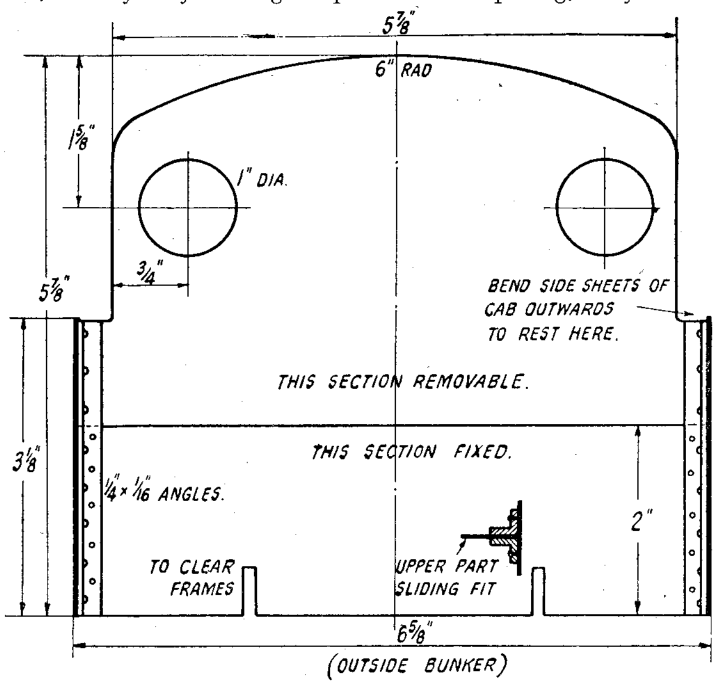
Side of bunker.

the cab back are simply inserted in the slides, and the whole lot drops into place. If desired, the ventilator in the cab roof (which is made to open) could be made a little larger, and the regulator handle and whistle operated through it.

A piece of metal 11 in. long and 4½ in. wide will make the sides and roof of the cab. Bend it to the outline of the weatherboard and cab back, being careful to make a snug fit all round. Next, cut out the arch-shaped openings at each side, for which job the saw mentioned above comes in handiest, as it does not distort the shape of the metal. Then bend outwards, at the bottom of the openings, the pieces that fill up the spaces between the cab and sides of tanks and bunker, the cab being ¾ in. narrower, all told, than those components. When I first saw a picture of the "3F" class tanks, I wondered why the designer did not make

the cab, tanks and bunker all same width; but when I saw a cross-sectional drawing superimposed on the outline of the loading gauge, the latter showing the minimum clearances on some of the "foreign" lines the engines have to work over, the reason was pretty plain.

The front and back edges of the cab at each side are cut away for 1/16 in. to a height of $1\frac{3}{4}$ in., so that the roof section is slightly wider (see illustration). A hole $1\frac{1}{2}$ in. square is cut in the roof for the ventilator. This is covered by a little flanged lid, made by cutting out a piece of metal $1\frac{3}{4}$ in. square and flanging it $\frac{1}{8}$ in. all around, over a $1\frac{1}{2}$-in. square former with rounded corners, exactly as you flanged up



Back of cab.

the boiler plates. Four little pieces of angle are riveted to the underside of the cab roof, one at each corner of the square hole, and the cover is just pushed on over them, the "spring" of the angles holding it in position. The sides and top of the cab can then be permanently attached to the back sheet. If brass has been used for the whole doings, ordinary soldering will do the trick, with a little piece of angle-brass riveted in each bottom corner, to afford extra strength. If cab and back sheet are steel, or galvanised iron, put a piece of angle at each side, and a curved piece along the top—a continuous angle would be difficult to bend at the sharp radii—and rivet the lot; alternatively, the "putting-on tool," if available, could be pressed into service once more, and the joint Sifbronzed or brass-brazed all the way around. This makes the best and neatest job if done properly.

On the full-sized engines, the rain strips are formed by pieces of angle. If you want to reproduce this, the angles will have to be home-made, for they will be only 1/16 in. on the flats. Half-round wire looks just as well on a little engine, and can be soldered in position, whatever metal the cab is made from; if blue steel is filed or scraped bright, it can be soldered very readily, but all traces of flux must be scrubbed off, or the metal will go rusty, and flake off the paint. The flat beading, which is fixed all around the cab opening, may also be half-round wire, or the narrow flat strip known as "ticket-wire," either of which may be attached by soldering. Great care should be taken to get the top and sides of the cab square with the back; and the pieces of angle inside the bunker should be set the exact distance apart to form a runner at each side for the cab back sheet, so that when the back is inserted in the runners the whole lot drops down and does not jam. The lower edge of the back sheet should rest on and lie flush with the permanently-fixed bottom part of the cab back, whilst the front end of the cab should drop over the weatherboard and make contact all around, without "showing daylight" at the joint. The little bent-out pieces at each side of the

cab should lie flush with the top of bunker and side tanks.

The coal-rails around the top of the bunker are made from ⅛-in. by 1/16-in. flat strip, either brass or steel, bent to the outline of the bunker top, and attached by small vertical pieces of the same material, riveted to the rails and the inside of the bunker sheets. Domestic pins make nobby rivets for jobs like these; incidentally, it does not seem to be generally known that 1/32-in. rivets, both brass and iron, are commercial articles in normal times, and can be obtained from most metal merchants at a very cheap rate. I don't use many myself, preferring a smooth flush surface to a "knobbly" one on my engines; but those good folk whose tastes are similar to those of our old friend "Bill Massive," and wish to reproduce all the rivets of a full-sized locomotive on their small editions, might find the information of use when Adolf & Co. have surrendered their "third singles" to a ticket collector with two horns and a tail instead of a bag and punch. As the cab is narrower than the bunker, the cab ends of the coal-rails must be neatly bent back towards the centre line of the engine, and a short piece of the flat strip riveted or soldered across the ends, as a spacer; don't rivet or solder them to the back sheet of the cab, like Molly's big sisters, or you'll feel like kicking yourself when you try to lift the cab off!

The handrail pillars at each side of the engineman's entrances can be made from 3/32-in. wire, either steel or nickel-bronze, poked through holes drilled in the running-board with a nut above and below it; the upper ends of the pillars can be turned down and pushed through a tiny hole drilled in the beading. Countersink this hole at the top, rivet over the spigot, and file off flush. On "Molly's" big sisters these pillars are tapered; if you want to reproduce that, it is a bit of a ticklish job turning the long pillars from ⅛-in. round rod, but it can be done by running between centres and using a steady behind the tool. Alternatively, for those who haven't a steady and no time to rig one up, use the chuck to hold the ⅛-in. rod. Have ½ in. projecting, turn that to an approximate size, then pull out another ½ in., "ditto repeating" until you have turned the full length of the pillar; a touch with a fine file, with the work running at high speed, followed up by an application of fine emery-cloth, will produce an excellent finish. The upper end of a turned pillar should be fixed to the beading as mentioned above, whilst the bottom end can be shouldered down to 3/32 in diameter and screwed, the spigot going through a No. 40 hole in the running-board and having a nut underneath to keep it all secure. Hand brake will be the next item to be dealt with.

Locomotives Built with Home-made Castings

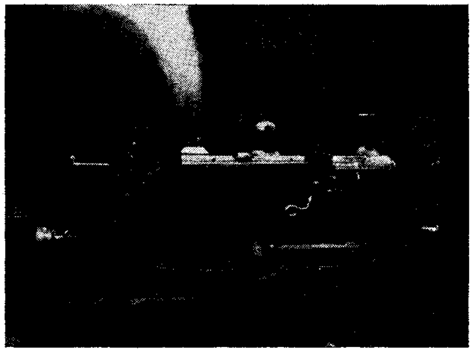
Mr. Carlyle's article on home ironfoundry in June 4th issue reminded your humble servant of a couple of 4¾-in. gauge locomotives, the castings of which were all home-made. One is a Brighton "Baltic" tank of the "Remembrance" class, and the other a Southern "Lord Nelson," both of them being the handiwork of Mr. C. Bright, a Sydenham builder, and very fine jobs they are, especially the latter, although it has only two cylinders instead of four, "for the sake of simplicity." After a certain party usually known as Jerry paid Mr. Frank Baldwin a flying visit toward the end of 1940, the latter's workshop was hardly in a fit condition for locomotive building, and Mr. Bright stepped into the breach (literally!) by offering "Bro. Frankie" the use of his workshop. This contains a Pool lathe and other tools, and is power-driven by a gas engine. In company with Mr. C. Haller, I recently paid friend Baldwin a visit there, to inspect progress on a 2-8-0 Gresley engine which he is building for Mr. Haller; and whilst there, Mr. Bright showed me the locomotives, also the patterns for the castings, and some sample castings that he had made for stationary engine work. He also explained how the castings were made. Mainly due to press of other work—the building trade finds plenty to do nowadays!—his locomotive-building is at a standstill, but he hopes to resume when times are normal again. Maybe, I will be able to get a picture or two and a description of Mr. Bright's work, for it is a shame that such fine craftsmanship should be hidden away, unhonoured and unsung. Truly, those who do most talk least! I was glad, at any rate, to see "old Frank" still going merry and bright, for his work, too, has never received what I call full recognition, although he has turned out some very fine jobs; for example, the Great Western 0-6-0 designed by Mr. J. N. Maskelyne for Mr. A. Maxwell.

Speaking of Jerry, that unworthy makes himself a confounded nuisance at times, for when he recently visited Canterbury, he must needs call on the East Kent Live Steam Co., with the result that after his hurried departure, the E.K. were very far from being O.K., so that readers who have recently written to the firm will now realise why their letters have not received attention. When Dr. Goebbels claimed that the Luftwaffe wrecked a British locomotive shop, by way of a change he spoke the truth!

A 1-in. Scale, 5-in. Gauge 0-4-2 Saddle-Tank Locomotive

By A. E. MASON

THE object I had in view when this locomotive was first thought of was to build a model to a fairly large scale, but of a very simple type in order to keep the size and weight down to a minimum, so that the locomotive could be handled by one person without assistance. This object has been achieved with a simple 6-wheel type with fixed wheelbase. The model weighs just 77 lb., boiler and tank empty. In working order the weight would be about 86 lb., and I can lift and carry her from the track unaided.



In steam as a side-tank engine.

It was originally intended to build a 2-4-0 tank engine, and patterns for inside cylinders were made and castings obtained from a local foundry. The cylinders were completed before anything else was attempted and when I tried the weight of these it seemed to me that this would be most useful on the driving wheels instead of over a pony truck.

So, accordingly, I made a sketch outline drawing of a 0-4-2 tank engine similar to the Southern Railway "D" class, of which I obtained two post-card photographs for a guide. It should be stated here that the locomotive was first built as a side-tank engine and ran for two summers in this form before conversion to its present form as a saddle-tank engine.

The cylinders and wheels are the only castings used in the construction, everything else being built up and brazed or silver-soldered. The frames are cut from $\frac{1}{8}$-in. thick sheet steel, and axle-box horns from $\frac{3}{4}$ in. $\times$ $\frac{3}{4}$ in. $\times$ $\frac{1}{8}$ in. angle.

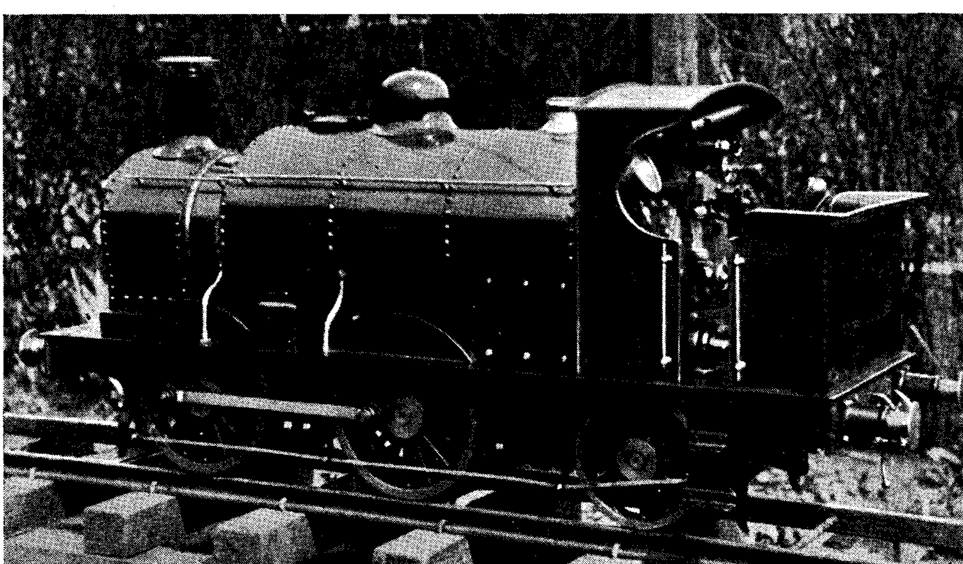
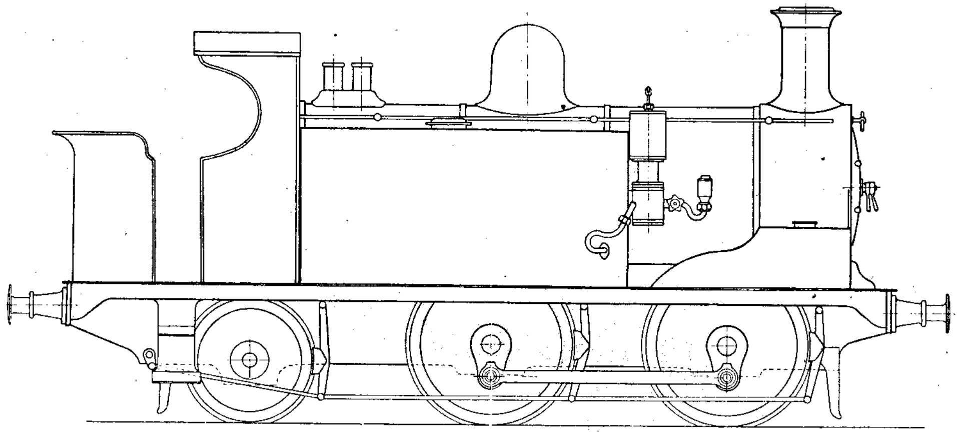


Photo. by] View showing cab fittings. [*W. Scotter*



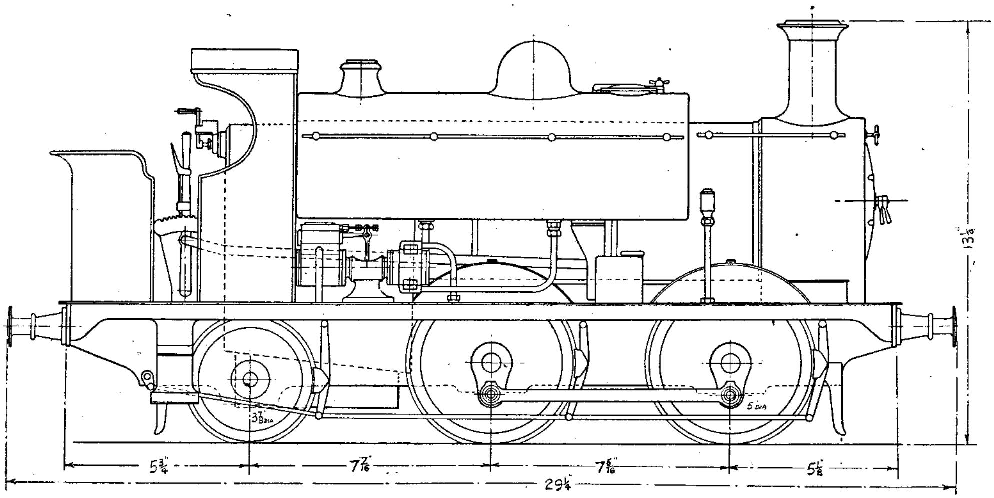
The 0-4-2 tank engine as originally built with side tanks.

The cylinders are 1 3/16-in. bore × 2-in. stroke and are cast-iron, cast-iron pistons and stainless-steel rods. Each piston has two hard brass rings, slide valves also are hard brass. Steam ports are ⅛ in. × 9/16 in., exhaust ports ¼ in. × 9/16 in., steam lap of slide valves 5/64 in. full, exhaust lap nil. These sizes were decided upon after studying advice given by Mr. G. S. Willoughby and others in reply to a letter of mine in THE MODEL ENGINEER for September 20th, 1934, and as I explained in a further letter in THE MODEL ENGINEER for November 15th, 1934, these port sizes and steam lap were the maximum I could allow for with the existing cylinder castings. However, I can state now that the locomotive is working, that she runs freely and at a high speed, pulling two or three passengers, with reversing lever on the notch nearest centre in either direction; also, the brass rings on the piston are wearing satisfactorily and have not given any trouble as yet.

The 5-in. dia. driving wheels are "Pioneer" castings, the balance weights being modified for the drivers but not for the front coupled wheels. The trailing wheels are 1 in. scale tender wheels turned to 3⅞ in. dia. on the tread. The crankshaft is cut from ¾-in. thick steel, rough turned, twisted hot to 90 deg. and then finished turned to size.

The 3/16-in. ball snifting-valves are placed on the steam-chest cover, the slide valves being underneath the inside cylinders, and valves are operated by usual Stephenson link motion with launch-type links.

The boiler barrel is seamless copper tube 4½ in. outside dia. × 15-gauge, the firebox wrapper and the flanged plates, also inner firebox, are all 3/32-in. thick copper sheet, riveted with ⅛-in. dia. copper rivets. The inner firebox is silver-soldered and riveted,



The 0-4-2 tank engine as now built with saddle tank.

and a fusible plug fitted in case water level is accidentally run down low. The first locomotive boiler I made (not for this engine) was riveted and sweated all through, and when the water ran down low by accident, the solder of the joints ran as well as the fusible plug, so I always hard-solder my inner fireboxes now. The boiler is 18 in. long from front tube plate to back plate, and firegrate is 5 in. long × 3 in. wide approximately. There are nine fire tubes 9/16 in. dia., and two tubes ¾ in. dia. for superheater elements. Stroudley-type regulator is fitted in the steam dome, and fittings include water gauge with ¼-in. dia. glass, steam blower, steam gauge reading to 100 lb. per sq. in., blow-down cock, and two feed-water clack valves at the front end of boiler barrel. A hand-lever feed-pump is fitted in the cab, also steam pump with shuttle-operated "D" valve on steam side and double-acting water pump. This last item has been modified quite a bit; in its present form it is mounted horizontally on the right-hand running board just in front of cab. When first made, it was mounted vertically and had a single-acting water pump, but would always fly one stroke until I fitted it with a double-acting water pump. It now works quite steadily and can be shut down to run dead slow.

Exact Dead Centre

The locomotive was tried with compressed air before the boiler was commenced and gave promise of good performance, the beats of exhaust being quite even in either direction. When setting the valves I took care to find the exact dead centres by a method described in an engineering pocket book. Before commencing to find the dead centres, an index pointer was made up to clamp on to the frames. With this pointer clamped to the frame the wheels are turned to a little beyond the dead centre to be found, and a mark scribed on both slide bar and crosshead, also another mark opposite index pointer, then turn engine the other side of dead centre until marks made on crosshead and slide bar again coincide and make another mark on driving wheel opposite index pointer. Bisect the distance between the two marks on driving wheel, making a definite mark exactly halfway between them.

This last mark made on driving wheel gives the exact dead centre when opposite index pointer, and for a two-cylinder engine the process requires to be done four times, but it is well worth the trouble, as it is impossible to ascertain the exact dead centre by mere inspection, especially for an inside-cylindered engine. My valves are set for

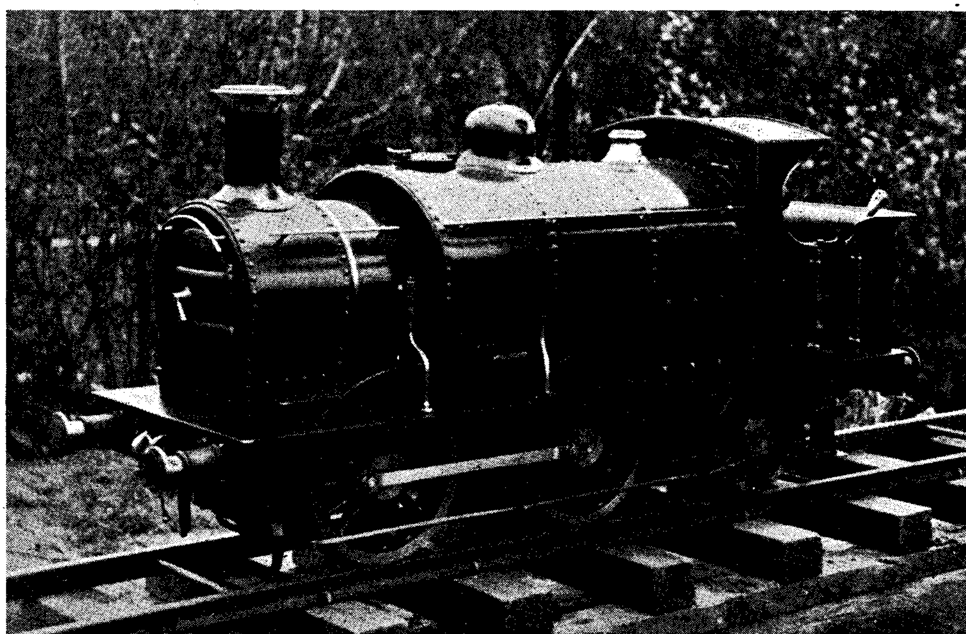


Photo. by] **Ready for steaming.** [*W. Scotter*

equal lead opening at each end of the stroke, so it is important to find the exact dead centre. The setting is as recommended in "Live Steam Notes," just a crack of port opening when on the dead centre. With the locomotive in steam and on the track, I can put the lever on the centre notch, open the regulator and the engine will run in either direction if given a push; running on the lead steam only, the lead with the lever in this position is somewhat increased, a feature of the Stephenson gear with open rods.

The engine brakes are operated by a screw-down handle in the cab and are fitted more for appearance than for use, the brake on the truck being more effective.

Converting to Saddle-tank

After the engine had ran for two seasons as a side-tank engine it was taken down and I was somewhat surprised at the wear which had taken place, and this I attributed to lack of oil, as I had always experienced difficulty in oiling up before a run, the side tanks prevented access to the motion, bearings, etc. After weighing up the possibility of converting to a tender engine, I hit upon the idea of making a saddle-tank. The conversion took me all one winter, and involved more work than just the tank. I made up a complete new smoke-box, also the steam pump was rebuilt and mounted horizontally instead of vertically, and I also removed one of the ¼-in. dia. safety-valves and fitted a plug in the bush not used. Originally the boiler had two ¼-in. bore valves, but the single valve is quite enough in my opinion.

Lubrication

The main axle-boxes now have a 3/32-in. dia. pipe running up to the spring lid oiler situated at the top of the splashers and the trailing axle-boxes are also similarly fitted. Using a good oil-can with spout extended a little with 3/32-in. dia. tube, I can now reach all the motion, etc., for oiling up. The cylinders are lubricated by mechanical lubricators, one on each side for each cylinder, and are driven off the leading axle via a rocking shaft. The oil is fed by ⅛ in. dia. pipes direct to a boss on top of each cylinder at the middle of cylinder, the hole through to cylinder bore being 1/32 in. dia. When first made up and tried out, these mechanical lubricators fed too much oil, so I took one away and made up a "tee" joint in piping for the other to feed both cylinders. However, when I converted the engine to a saddle-tank I also reduced the bore of oil pumps from 9/64 in. dia. to 7/64 in. dia. and fitted them both again, one for each cylinder. As now arranged, there is a slight film of oil around the chimney all the time the engine is working, but I do not get a sticky mess in the smoke-box after a run, as at first when both lubricators were fitted.

A First Run

I can well remember the day when I had finished laying my track and steamed up the engine for its first run. Steam was raised to working pressure (60-65 lb. per sq. in.), and I climbed aboard the flat truck with my five-year-old small daughter behind, and opening the regulator we raced down the track at a fine speed, only managing to pull up at the other end by putting both feet down. It scared the little girl, she kept off it for a while until I got rather more used to handling the engine.

The engine has performed well from the start; one improvement made after the first few trial runs was the reduction of the holes in the Stroudley regulator to wire-draw the steam, also they were so placed in the re-drilling to open one after the other instead of all four holes together. The effect of the change was to stop excessive priming when the regulator was opened up with a load of three to four adult passengers.

I also made a new superheater when the saddle-tank was fitted. This new superheater is much longer and reaches right down the whole length of tube to firebox.

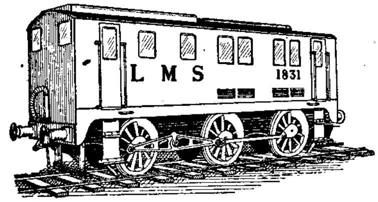
Hauling Capacity

The maximum load the engine has pulled on the level is six adult passengers, the most I can crowd on to the two flat trucks. The engine is simple to handle: quite recently I had it running and left the children in charge while I dug the garden, a neighbour's ten-year-old boy was driving and I gave occasional attention to the coal and water supply. I burn a mixture of house coal and anthracite and the boiler easily maintains full working pressure, the blower being let on very slightly to prevent the fire going dead when steam is shut off. My track is just a straight run up and down, about 120 ft. I have not been able to try out the locomotive for a continuous run, but have no doubt that she would keep going all right with a fair load up on a continuous circular track.

The locomotive is a free-lance design of my own and not a copy of any particular prototype.

In conclusion, I would like to pay tribute to the "Live Steam Notes" by "L.B.S.C.," which were so great a help to me while building this engine, the greater part of which was completed in two years' spare time.

I should be glad to meet any other 5-in. gauge locomotive enthusiast in or near Rugby.



EDGAR T. WESTBURY'S 1831

*A 3½-in. gauge I.C. Engine-driven Locomotive

Withdrawal Cam and Lever (Fig. 127)

IT will be seen that the cam is shown with the shaft turned integrally ; as an alternative, it may be made separately, and pressed on and pinned to a piece of 3/16-in. round steel rod. The one-piece component, however, will be practically as easy to make, and has the advantage that it cannot come adrift, except by actual breakage. A piece of ⅝ in. dia. mild steel provides sufficient material to allow of skimming up the outer diameter of the cam, and the total length turned down to form the shaft is 27/32 in. This should be made a close working fit in the bush ; the cam may now be parted off, reversed in the chuck and faced up on the inner side.

The shape of the back of the cam is not important, so long as it provides clearance to enable it to be turned through a fair angle. At the centre, it should be practically in contact with the bottom of the groove in the housing when assembled in position ; the front face is flattened, so as to lie exactly flush with the face of the housing, and the tips smoothly rounded off and polished. These shapes may be produced by filing, and there is no special advantage in machining them. The cam should finally be case-hardened, leaving the shaft, or at least the outer end of it, soft, to allow of fixing the lever to it.

The lever may be made from 5/16-in. × 3/16-in. flat mild-steel bar, tapered down to ¼ in. wide at the small end, and narrowed down to ⅛-in. thick at the sides, except for the centre boss. In order to drill the eye at the large end, a piece of bar of sufficient length should be marked out to show the position of the boss centre and held in the four-jaw chuck, with this centre running truly, and the face of the bar square with the lathe axis. The hole may then be started truly with a centre-drill, then drilled through undersize and reamered out to a light driving fit on the shaft of the withdrawal cam. At the same setting, the face of the bar can be machined back to ⅛ in. thick, leaving a circular boss concentric with the hole. The sides of the rod can be filed down taper after marking-out the hole at the small end and scribing a ¼-in. circle around it as a guide for shaping both the sides and rounding the end.

The lever is intended to be pinned to the shaft, but it may be advisable to leave this operation until the controls are fitted up. If it is desired to fix it for testing out, this may be done temporarily by means of a small set-screw ; or a still better idea would be to fit a temporary lever for this purpose.

Engine Afterthoughts

Many readers will be interested to learn that the engine of " 1831," constructed by Mr. Ian Bradley, several photographs of which in various stages of construction have been published, has been thoroughly tested out, and may without hesitation be pronounced a complete success. It is a consistently good starter, and runs reliably under load for any desired length of time without any signs of losing its tune or " getting tired," as some small engines are liable to do. With a simple form of silencer fitted, it is reasonably quiet, and it runs fairly cool with thermo-siphon water circulation, bearing out my opinion that the fitting of a water-circulating pump should not be necessary.

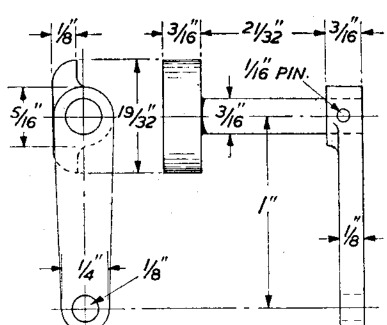


Fig. 127. Withdrawal cam and lever (1 off).

The carburettor has also entirely borne out the theories underlying its design, and there is no question whatever that flexibility, which is such a desirable feature in an engine of this type, can be, and indeed is, capable of attainment by the employment of a suitable type of carburettor. Ignition is

* *Continued from page* 34, " *M.E.*," *July* 9, 1942.

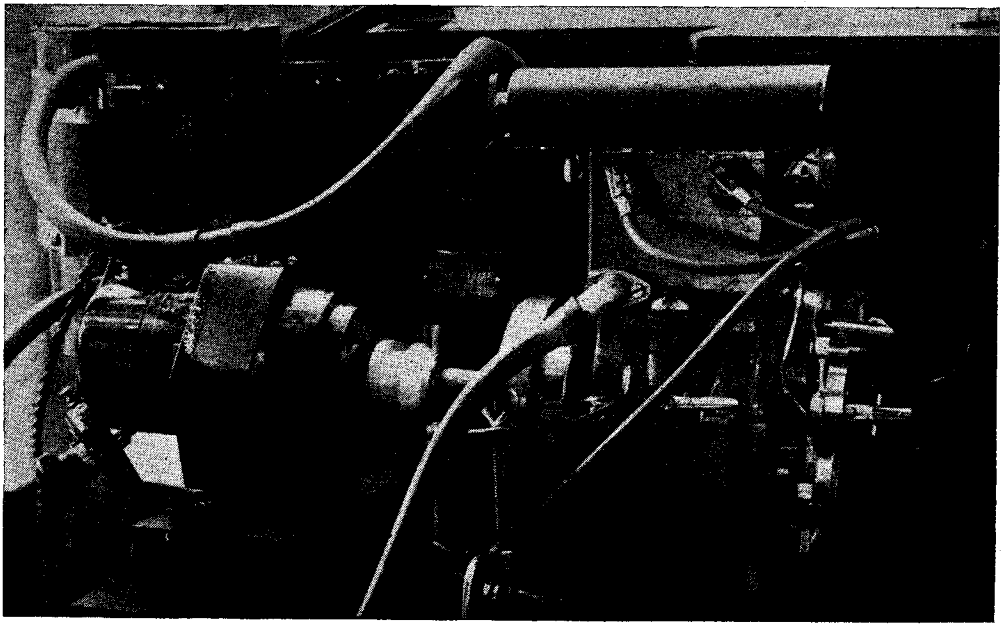
also quite satisfactory, at least so far as the equipment on the engine is concerned, though there have been one or two minor spots of bother with batteries and ignition coils—which, I think it will be agreed, can hardly be associated with matters of engine design.

The engine has been run under load, driving a motor-cycle generator of a type which is intended to run at fairly low speed, and is thus very inefficient when speeded up; the output obtained is from 90 to 100 watts at full throttle.

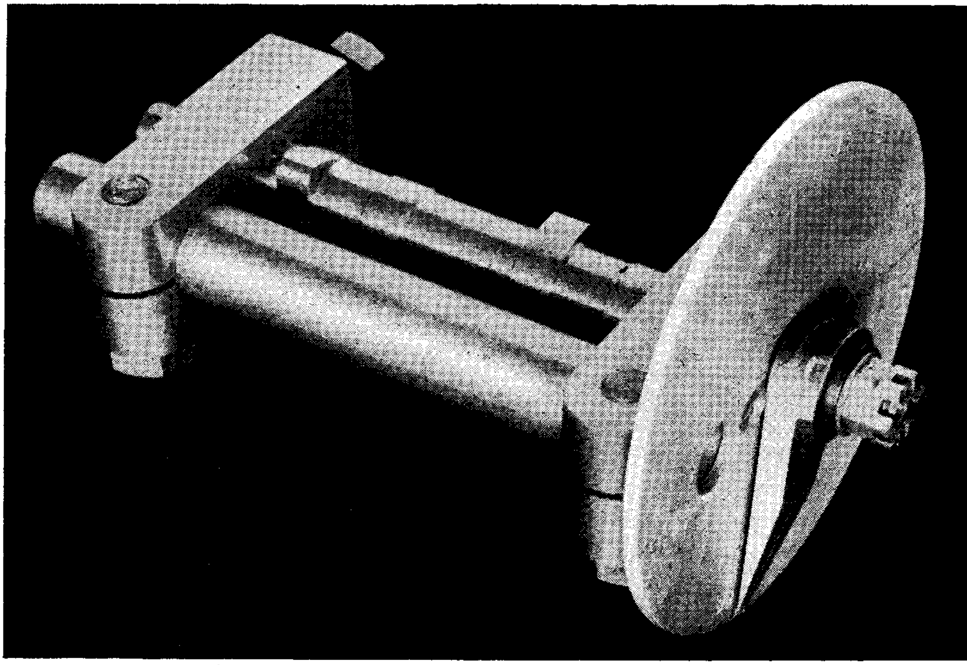
It may be mentioned that Mr. Bradley invariably starts this engine with a small hand crank applied to the starting dog on the end of the crankshaft—a method which can only be successful if the engine to which it is applied is a really good and consistent starter. The method of starting which it is proposed to apply when installed in the locomotive will provide for spinning the engine three or four revolutions at a fair speed, so that under these conditions it is reasonably safe to assume that no starting difficulty need be anticipated.

I do not pretend that the results described have been obtained without a few teething troubles. As a matter of fact, if ever I design or personally construct a small petrol engine which behaves in an exemplary manner right from the word "go," I shall find it extremely difficult to believe that there isn't a catch in it somewhere—I shall suspect that I am being led well and truly up the garden, and that the *real* trouble will start as soon as I have become convinced of its impossibility! New engines, like new babies, have their inevitable ailments, and it is best to get them over as soon as possible. If any readers contemplating the construction of this or any other petrol engine are of the particular temperament which cannot endure temporary set-backs, or are liable to lose patience when things don't go quite according to the book of words, then I advise them frankly it would be better to leave the job alone. Not that petrol engines, on the whole, are more troublesome than other forms of motive power; I hold the firm belief that the reverse is the case, but they often call for a good deal of patience in the early stages of their careers.

The teething troubles encountered with this particular engine have been certainly no worse, nor more baffling, than might reasonably be expected, and none of them is associated with the basic design; but in the course of tests it has been found possible to introduce several little detail improvements. I understand that Mr. Bradley intends to describe to readers how he has modified certain details with advantage, but I shall also have a few "afterthoughts" to deal with as soon as matters have arrived at complete, or at least satisfactory, stability. Readers who consider afterthoughts as a sign of bad design have my apologies, but, really, it is a far better policy to acquaint readers with everything,



Mr. Bradley's "1831" engine on bench test, coupled to a motor-cycle dynamo.



Camshaft-forming jig made by Mr. H. A. J. Lawrence, showing finished camshaft in position.

good or bad, that develops in the tests of a new engine than to imply that the design, once on paper, has reached finality and cannot be improved.

An Offer to Constructors

Mr. H. A. J. Lawrence, of Leamington Spa, who is constructing the engine of "1831," has written to me describing his experiences in the machining of the components, and making some helpful comments thereupon. He mentions that he has made the camshaft-forming jig which I described and has found it entirely satisfactory for its intended purpose. It has occurred to him that other constructors might like to have the use of this jig, and is willing to lend it, provided that carriage is paid on it both ways. This offer, typical of the helpful spirit which pervades model engineering activities, will undoubtedly be eagerly accepted by many readers, and I suggest that they should write to Mr. Lawrence direct, c/o Lawrence Dies and Machine Tools Ltd., Trinity Road, Leamington Spa. Enquiries will be dealt with in strict rotation.

I have inspected the camshaft jig (which, I need hardly add, is well made, and follows the essential principles specified in my description) and also several components of the engine which Mr. Lawrence has constructed, including the camshaft itself, the crankshaft, connecting-rods, and timing gears. These are all excellent examples of workmanship, and there is little doubt of the ultimate success of the engine if all parts are up to the standard of these specimens.

In connection with the machining of the camshaft, Mr. Lawrence mentions that he found the most efficient way of forming the base circles of the cams was to mount the shaft on its own centres and plane the metal away with a tool mounted on its side, the saddle being racked back and forth by hand. While I agree entirely that this is an excellent method, provided that the saddle and tool-post of the lathe are pretty rigid, my reason for recommending the rather more tedious method of turning the metal away on the jig was that it entails less risk of digging in, or running into the next cam, when the work is done on a rather flimsy lathe. In lathe work, as in most other affairs of life, "one man's meat is another man's poison," and the best method of doing any particular job will depend not only upon the available equipment, but also upon the training and temperament of the individual. The methods which I recommend are always intended as a guide to the uninitiated, rather than an attempt to convert those with sufficient experience to be able to tackle these problems in their own way.

(*To be continued*)

*Small Capstan Lathe Tools

Notes on "tooling up" for repetition work, with a special application to the "M.E." small capstan attachment

By "NED"

SOMETIMES definite upper and lower limits for knurled work are specified, and if these are less than about 0.005 in. altogether they may be found difficult to comply with. Sometimes small nuts are made with a straight knurl, with the object of moulding or pressing into plastic material, and this is the reason why their size is important.

Knurling also burrs out the material where it overlaps the ends of a turned diameter, and for this reason the knurling operation should in practically all cases be followed by a chamfering or undercutting tool.

Knurling Tools for Capstan Work

Knurling may be carried out in small capstan lathes either by means of a single or double slide-rest knurling tool, or by means of a balanced double knurling tool held in the capstan head. The former method may be the simpler in many cases, as it enables standard forms of knurling tools, such as those illustrated in Fig. 29, to be employed, but the capstan head holder has several practical advantages, and is generally preferred for production work. In the first place, it eliminates side thrust on the work or lathe mandrel, and as it is generally pre-set to suit the diameter of the work, it produces uniform results in the minimum time.

The usual form of capstan head knurling tool-holder consists of a U-shaped bracket, mounted on a shank by the centre of its yoke, and having two individually-adjustable holders for the knurling wheels mounted in the arms (Fig. 30). In addition to radial adjustment, it is usually possible to turn the holders so as to present the edges of the knurling wheels at a variable angle to the axis of the work. Thus it is possible to produce straight, spiral or cross knurling with only a single pair of straight knurling wheels mounted in the holders. The photograph of the tool-holder made by Mr. A. L. Steels represents a home-made example of this type of tool, which has been entirely successful for dealing with a wide range of production work. The main holder is built up from mild-steel bar by pinning and brazing the two arms to the yoke, but readers who are experienced in forge work would probably find it easier, and certainly no less satisfactory, to bend it up from a single piece. It is most important that the section of the material used for the U-piece should be sufficiently heavy to ensure rigidity, as the working stress tends to spread the arms apart, and the holes in which the individual holders are fitted should be exactly opposite each other and square with the axis of the shank. A close fit of the holders in these holes is also essential, otherwise they will tend to cant over when working, and thus the knurling will be tapered, i.e. deeper at one side of the wheel than at the other.

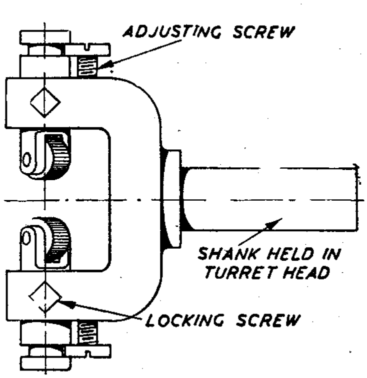


Fig. 30. Capstan-head knurling tool, with radially adjustable and swivelling knurling wheel holders.

"Wangling"

Although the form of tool illustrated is undoubtedly very satisfactory for its intended purpose, it has a rather serious disadvantage for use in small capstan lathes, in that it takes up an abnormal amount of room, making it difficult to accommodate without cramping or impeding access to other tools, or interfering with the rotation of the capstan head. It is often found necessary to resort to "wangling" of the sequence of the capstan tools, or to rotate the knurling holder around its shank axis until the most convenient position has been arrived at.

In the attempt to reduce the amount of room taken up by the knurling tool-holder, several special types of holders have been devised and introduced as items of equipment on various makes of small capstans and autos; but, generally speaking, what these tools gain in compactness, they lose in daptability. It is nearly always necessary to sacrifice the individual swivelling adjustment of the knurls so that different wheels are necessary to produce various forms of knurling; but this may not constitute a very serious drawback in practice. The range of sizing

* *Continued from page 45, "M.E.," July 9, 1942.*

adjustment to suit work diameter is nearly always reduced.

One form of knurling tool-holder consists of a cylindrical head similar to an expanding die-head, and resembling the latter in other respects, as the knurling wheels are fitted to holders in radial slides and their radial movement is controlled by a double scroll cam. This type of tool is not only automatically centred and capable of being pre-set to fine limits, but can also be released to clear the work entirely, so that it becomes possible to carry out knurling operations behind a plain collar of larger diameter than the knurled portion, which would not otherwise be possible with a capstan head knurling tool.

A Modified Capstan Head Knurling Tool-holder

Fig. 31 illustates a simple form of holder which has a good deal less overhanging bulk than the U-bracket type, and is adaptable to all usual forms of knurling, either by changing the wheels or the individual holders in which they are fitted. It will be seen that the latter are made in the form of small die-blocks, which slide in slots in a faceplate adapted to fit the capstan-head socket, and are controlled by screws in the same manner as the jaws of a four-jaw chuck. By way of improvement, the die-blocks may be made self-centring by using a single adjusting screw with right- and left-handed threads, passing right through the mounting plate, to control the radial adjustment. The use of independent screws, however, enables the shank to be left hollow to admit small diameter work.

In order to adapt the device for spiral or cross knurling, either the wheels may be changed, or different die blocks, having their mounting slots machined to an appropriate angle, may be fitted to the plate. As nearly all spiral and cross milling specified in production work calls for a 45-deg. angle, it would only be necessary to provide one spare pair of die-blocks.

When the knurling wheels have been set for work of a given size, they can be locked rigidly by clamping up the nuts at the back of the die-blocks. This form of holder also embodies the advantage that the knurling wheels can be run up very close to the chuck, or a shoulder on the work, without risk of fouling projections on the holder.

Limitations of Capstan Head Knurling Tools

There are some instances where the use of a knurling tool applied endwise from the capstan head is either impossible or inconvenient. This may occur, for instance, in complex work, where the capstan-head stations are fully occupied with other tools; another, and more common case, is when it is necessary to leave a collar on the end of the work, of the same diameter as, or larger than, the part to be knurled (the special "expanding" knurling head, referred to above, would, however, overcome this difficulty). Occasionally it is necessary to use some form of knurling which definitely precludes endwise traversing of the knurling tool; electric terminal nuts sometimes have convex knurling, and there are also instances of concave knurling on some components.

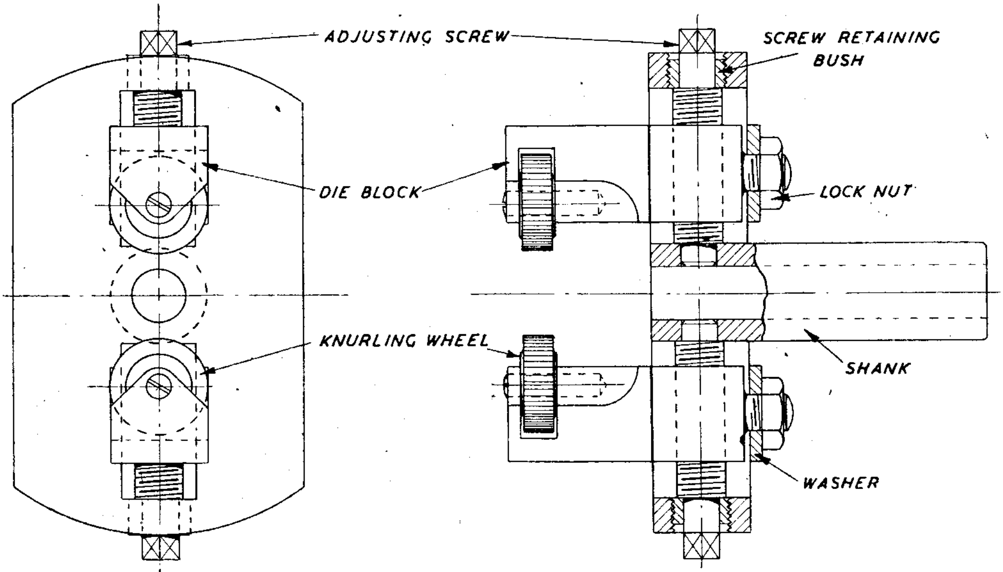


Fig. 31. Modified form of double knurling tool for capstan head.

These operations can only be dealt with successfully by means of a slide-rest knurling tool, in which case the standard forms of such tools as illustrated in Fig. 29 are quite suitable. The double knurling tool in this figure does not provide a balanced action, but there is one standard form of double knurling tool which has the knurl holders mounted in a slide, with vertical adjustment by right- and left-hand screw. This type is much to be preferred, as it enables the knurls to be pre-set to the size of the work, and to be run "over the dead centre," thus producing uniformly-sized work, and eliminating side thrust. Another standard form of knurling tool incorporates a rotating turret head, which enables different kinds of knurls to be brought into operation instantly—it is important, however, to watch that the knurling pattern is not changed by accident in this case!

Features and Advantages

All the special forms of knurling tool holders have their own particular features and advantages, but very often their usefulness is limited by the amount of room which they occupy on the cross slide, and therefore, the plain single knurl holder is often the most practical type to apply. Another problem which arises in cross slide knurling is that it is often necessary to carry out both forming and parting-off by cross slide tools, and thus both front and back tool-posts are fully occupied.

The use of a turret tool-post is often cumbersome and inconvenient in a small lathe, though in some cases it is practically the only way out of such a problem. If the knurling tool can be run over the dead centre, it is sometimes practicable, by the use of a special tool-post, to mount a forming or parting tool *behind* it, so as to come into action at the limit of its travel. Some capstan lathes have been fitted with a swinging arm which can be used to carry an additional tool, such as a knurling tool, for radial application. One hears occasionally of knurling being done with a hand tool-holder, but speaking from personal experience, the writer has never seen this done successfully, and there would appear to be several practical arguments against it in production work.

Capstan Slide Traversing Gear

Some questions have recently been put to me by readers regarding the respective merits of different methods of traversing the capstan slides. The majority of capstan lathes in modern production practice are equipped with a windlass, having a pinion which meshes with a rack on the capstan slide; this method has been proved by experience to be efficient and to provide a fairly sensitive control of the feed of the capstan tools. But in THE MODEL ENGINEER Capstan Attachment, a simple lever feed has been specified, and the question arises whether any advantage would be gained by altering this to a rack system. It may be observed that the attachment recently described by Mr. A. L. Steels was so equipped, and another contributor, Mr. E. W. Fraser, who described a very useful steady tool for use with this attachment, suggested that rack feed would constitute an improvement.

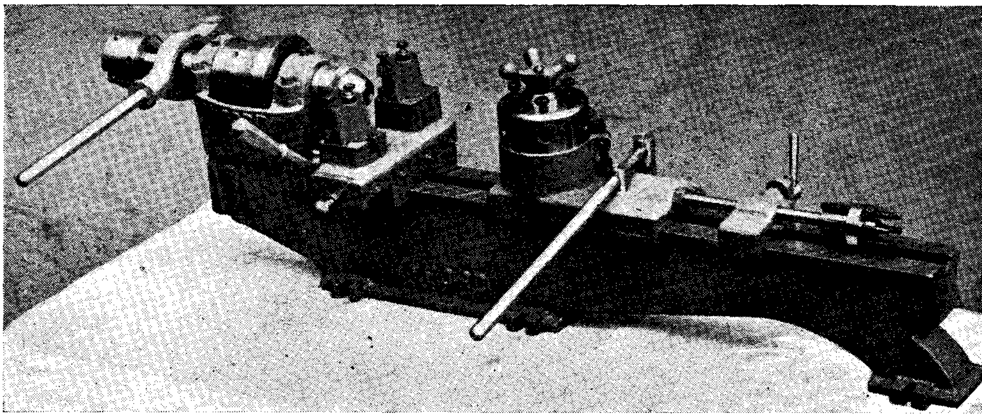
Although it is frankly admitted that the main object in specifying lever-feed in the original design was to simplify construction, it does not necessarily follow that the more elaborate traversing system would invariably constitute an improvement. The main advantage in the use of the rack system is that it enables any desired leverage to be applied over any desired length of travel. These properties may be very useful when the stroke of the capstan slide tools is long, and the power necessary to feed them is fairly considerable.

More Sensitive

But in the work for which the attachment was primarily designed, the stroke is usually quite short and the cutting resistance light, and for such purposes the lever-feed is quite well suited. Its main advantage in this case is that, apart from mechanical simplicity, its action on the slide is more direct than the rack-and-pinion gear, thus feed control is more sensitive, and backlash more completely eliminated. Backlash in the feed gear may be troublesome, especially when the cutting tools have the least tendency to snatch; and in order to eliminate it with rack-and-pinion gear, the latter must be very accurately made and fitted. It may be observed that in capstan lathes used for horological and instrument manufacture, lever feed to the capstan slide is often preferred, even in quite elaborate and expensive lathes.

Duties

It is clear, therefore, that the pros and cons of the respective methods of traversing must be considered in terms of the kind of duty they have to perform; as a general rule it may be said that rack-and-pinion traverse is better suited to the heavier classes of work, entailing moderate speeds and deep cuts, while lever feed is at its best on small jobs, running at high speed, and taking fairly light cuts. Both kinds of work often have to be dealt with in small production shops, but the latter is likely to be the more frequently encountered by the user of the attachment in question.



The Myford light capstan lathe.

An Interesting Light Capstan Lathe

The photograph herewith shows a small capstan lathe produced by a firm well known to all model engineers, as their name is associated with a very successful but inexpensive lathe which forms the backbone of many an amateur workshop. The production illustrated, which is in extensive use for the production of small components in armaments factories, embodies many features in which full advantage has been taken of the experience gained in catering for that very exacting and discriminating user, the model engineer.

The capstan lathe embodies a very sturdy headstock with a large diameter hollow mandrel, fitted with two-speed cone pulley. It incorporates an automatic collet chuck, operated through toggle mechanism, and an internal push-tube, from a lever at the tail of the mandrel. A six-station rotating tool head is provided, with hand indexing and lock-release.

A " Turret " Lathe

In view of the terminology accepted largely in the machine tool trade, it would seem that this type of machine tool should correctly be termed a " turret " lathe, as the tool slide is fitted directly to the lathe bed, instead of being carried on a subsidiary slide clamped thereto, as is usual in capstan lathe practice. (But apart from mere pedantry, the term " capstan lathe " will undoubtedly be universally accepted in defining any small machine tool in this class.) The slide is lever operated, and a rotating stop holder is attached to the rear end, the stops abutting on a fixed stop mounted in a small slide clamped to the bed. It is thus possible to operate the slide over any portion of the lathe bed, within the limits of travel provided by the feed lever.

A massive cross slide, also adjustable on the bed for longitudinal position, is provided, with front and rear tool posts, and is operated by means of a lever. Travel in one direction is limited by a screw-adjusted end stop.

The Bed

The bed of the lathe is of similar general design to that employed in the model engineering lathes, but is stiffened up, and in addition to the mounting feet under the centre of gravity of the bed, it is further supported by an additional foot at the tail end. This highly practical little production machine tool is produced by the Myford Engineering Co. Ltd., Neville Works, Beeston, Notts. Although, in common with all machine tool manufacturers, they are extremely busy these days, their policy of works expansion to cope with increasing demands enables them to offer fairly early deliveries of this and other tools for urgent war work, though their ability to oblige private customers must necessarily be curtailed under present conditions.

(*To be continued*)

Ironfounding at Home

With reference to Mr. C. B. Carlyle's article on this subject, published in our issue of June 4th last, we understand that the Morgan Crucible Company has had a number of enquiries for their Salamander No. 6 Crucibles. This size is one that the company is now not able to deal with in small quantities, but we are pleased to inform readers that arrangements have been made whereby Messrs. Griffin and Tatlock Ltd., Kemble Street, Kingsway, London, W.C.1, can supply crucibles of the type and size mentioned. Readers are requested, therefore, to send enquiries to Messrs. Griffin and Tatlock, who can ensure delivery.

*ORGANISING the Amateur Workshop

By IAN BRADLEY

BEFORE leaving this screwing tackle question, I would recommend all amateurs to get one or more tailstock die-holders. These are invaluable for screwing special bolts and fittings in the lathe, and whilst I suppose one must not, for obvious reasons, claim that the results they produce are the equivalent to actual lathe screw-cutting with a single tool, they must run very close, in so far as accuracy is concerned, with the added advantage of rapidity in action.

The two die-holders shown here are commercial products; but they can very easily be made by the amateur himself, and their possession greatly facilitates working. No special equipment is necessary for holding taps in the lathe; an ordinary drill-chuck in the tailstock being all that is required.

Storage of Material

The proper storage of material is of paramount importance, and proper and adequate methods of dealing with the matter are essential.

My own method is to keep the raw material in racks, all scrap ends being put in appropriate boxes. I divide my storage up under three headings—steel, brass and light alloy—and these are further divided up into rounds, hexagons and flats.

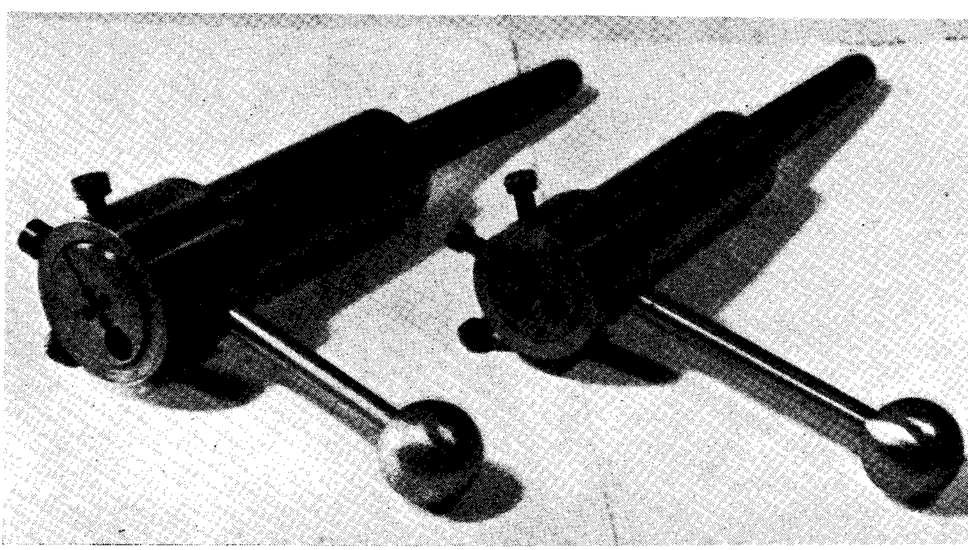
Separate partitions are provided, wherever possible, for these sections. The illustration reproduced here will show the arrangement. So far as the brass and light alloy are concerned, no special precautions are necessary to avoid damp (except in the case of certain magnesium alloys not usually found in the amateur shop), but the steel sections must be well " slushed " with oil in order to avoid rusting. Where space is available, horizontal storing is to be preferred, as it makes the sections easy to identify. When buying sections, I aim to get them in 2-ft. lengths, as this, in my case, facilitates storage. I have mentioned that short ends should not be put with the main stock. By short ends I mean pieces under 6 in. long. The storage of these in a special box, from which they can easily be sorted as required, is essential.

Bolts, Screws and Nuts

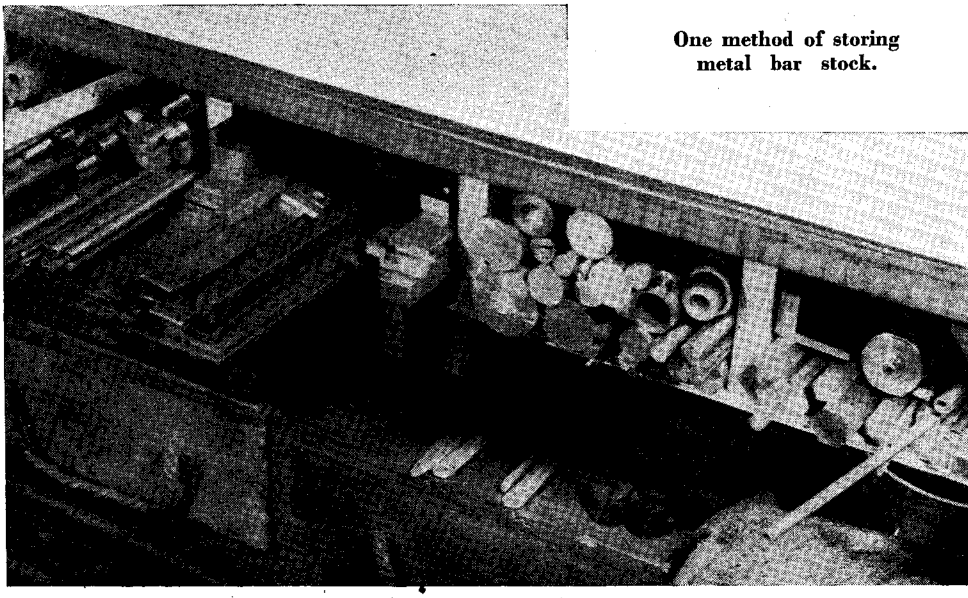
The storage of bolts, screws and nuts is one where considerable care must be exercised if they are to be easy to handle.

In the larger sizes, the amateur shop will probably not need a great many and so over

* *Continued from page* 68, " *M.E.*," *July* 16, 1942.



Two tailstock die-holders.



One method of storing metal bar stock.

$\frac{1}{4}$ in. diameter, or its approximate equivalent 0 B.A., it is usually sufficient to keep all sizes to $\frac{1}{2}$ in. in a drawer to themselves, or, if a little further separation is thought desirable, in individual tins (old tobacco tins), which can be kept together in one drawer. The bolts and nuts should be oiled before they are put into tins.

Now for the small stuff. If a fair quantity of stock is envisaged, a drawer divided off into compartments is the best solution. The screws and nuts may then be segregated according to size and type and also, if there is sufficient room, according to length. For those who do not wish, for one reason or another, to go to these lengths, old tobacco tins may be pressed into service. Identification in this case is best carried out by sticking on labels cut from surgical adhesive tape and marking them with an indelible pencil

As to odd bolts and nuts which accrue from time to time, due to the stripping down of small mechanisms, my own plan is to throw all these together into one tin and then at intervals to sort out the best of them and put them amongst the main stock in their appropriate location ; any odd bolts or nuts which cannot be classified being retained in the bolt " junk box."

Some may be inclined to wonder whether all this work will leave little time for the real job in the shop ; my reply is that if the shop is systematised and tidy, such work as sorting out odd bolts and nuts takes much less time to do than to write about, and, anyway, such a job does not require doing very often.

Storage of Junk

The storage of junk is a very controversial matter. I freely admit that in thirty years I have certainly not evolved the perfect plan. There are very often times when I look for some particular bit of junk which I *know* I possess, only to be totally unable to find it (it, of course, invariably comes to light when it is too late for the job for which it was required).

For want of any better method, I divide my bits and pieces as under :—

(A) Mechanical junk.
(B) Electrical do.

These are then further divided into the more obvious sub-classifications such as, in the case of the mechanical junk, gears, small pulleys, odd ball-races, car and motor-cycle fittings and the like ; whilst the electrical material gets sub-classified as switches, odd electric fittings, cable and wire, odd radio material, moulded material, terminals and so on.

Storage is provided in a number of strong boxes and in the large cupboard previously illustrated ; as with the " junk " bolts and nuts, the whole store is reviewed occasionally, as this helps to refresh the memory (most important this) and enables re-classification to be carried out. The method is not foolproof, but it is one step towards organising this somewhat difficult matter. If my recommendations prompt our readers to help in suggestions as to junk storage, their ideas will be most gratefully received.

(To be continued)

Letters

Old-time Models

DEAR SIR,—The recent references in THE MODEL ENGINEER to old-time examples of the model maker's craft have prompted me to ask if any reader can throw any light on the model Stroudley single-wheeler "Connaught" which for many years stood in its glass case at London Bridge Station, L.B. & S.C.R., in the circulating area near the local line platforms (as then laid out) on the western side of the station.

The model was made largely, if not entirely, of wood. It was the work of a former Brighton Railway Station Master, and was used as a "collection box" to raise funds for philanthropic work connected with the railway service.

I often saw the model in my boyhood days of the 1890's and early 1900's, and how I longed to become the owner!

It was beautifully painted in the old Brighton yellow livery, and looked most attractive. The tender was used as a receptacle for the coins which patrons of the fund inserted in a slot on one side of the glass case, and by a chute were fed into the top of the tender.

I have often wondered what became of the old model, and should be most interested if any reader has any information on the subject.

Yours faithfully,

Liverpool. WM. E. BRIGGS.

Another Remarkable Watch

DEAR SIR,—*Re* the remarkable watch reproduced on page 618 in the June 25th issue of THE MODEL ENGINEER.

I would mention that I also have a pocket watch with stop watch combination, a beautifully made piece of Swiss work, and it contains, fitted in amongst the mass of works, a small box of spare parts such as top and bottom bearing plates fully jewelled, minute ratchet wheels, screws, and several other delicate bits and pieces.

No doubt the idea is such as mentioned by your correspondent, as the parts would obviously be difficult to obtain.

The watch maker who obtained the watch for me remarked that in all his experience, and he was an elderly man, he had never before heard of or seen the like.

We do bump up against things, don't we, chum?—I've been a reader of THE MODEL ENGINEER for about 40 years. and there always seems to be something new in it.

Yours faithfully,

Lewisham. J. R. LONGHURST.

Clubs

The Society of Model and Experimental Engineers

There was a good attendance for the last meeting before the summer vacation, which was held at The Caxton Hall, Westminster, on Friday, 10th July. Mr. F. B. Lowe, of Palmers Green, was elected to membership. A series of lecturettes by members had been arranged, the first, by Mr. E. C. Yalden, being entitled, "Some Examples of Engineering Production." This lecturette dealt with the courses given to trainees in a South-East London establishment, and the exercises in various operations were fully described. Samples of the work produced were passed round for inspection. Mr. W. C. Lister followed with a description of a precision rotary switch which Messrs. Muirhead's had recently put into production, and specimens of this instrument in various stages of assembly were greatly admired. Mr. H. H. Fenn exhibited a partly completed model compound marine engine. Meetings are now suspended until the beginning of September,

Secretary: H. V. STEELE, 14, Ross Road, London, S.E.25.

The West Midlands Model Engineering Society (Wolverhampton Branch)

It was decided at the last meeting of the above Society to cancel the next two monthly meetings, and then to start in earnest on Wednesday, September 23rd, at our headquarters, the "Red Lion" Hotel, Snow Hill.

In the meantime, will members keep in touch with each other and also induce their friends to come along and join the Society.

Hon. Secretary: F. J. WEDGE, 13, Holly Grove, Penn Fields, Wolverhampton.

The Kent Model Engineering Society.

The next meeting of the Society will be held on Tuesday, July 28th, at Sportsbank Hall, Catford, S.E.6, at 7.30 p.m.

Mr. F. Bradford will describe the construction of his free-lance $3\frac{1}{2}$-in. gauge locomotive.

The meeting for August 4th will take the form of ten-minute talks on model engineering topics by various members. August 11th, Mr. Davidson on "Small Lathe Construction."

Hon. Secretary: W. R. COOK, 103, Engleheart Road, S.E.6.

NOTICES.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to Percival Marshall and Co. Ltd., Cordwallis Works, Cordwallis Road, Maidenhead, Berks.

All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," Cordwallis Works, Cordwallis Road, Maidenhead, Berks.